Citation:

Williams BM, O'Neil CE, Keast DR, Cho S, Nicklas TA. Are breakfast consumption patterns associated with weight status and nutrient adequacy in African-American children? *Public Health Nutr.* 2009 Apr;12(4):489-96. Epub 2008 May 27.

PubMed ID: 18503723

Study Design:

Cross-sectional Analysis

Class:

D - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

To determine the association between weight status, nutrient intake and dietary adequacy in African American children who skip breakfast, consume a breakfast that includes Ready-To-Eat-Cereal (RTEC) or consume a breakfast without RTEC.

Inclusion Criteria:

All subjects were part of the National Health and Nutrition Examination Survey (NHANES), whose data was collected from 1999 to 2002.

Exclusion Criteria:

- Excluded if they were not African American
- No other exclusion criteria described

Description of Study Protocol:

Recruitment

NHANES data. Classification of race was self-reported and based on US census categories.

Design: Cross-sectional analysis. Secondary analysis of the NHANES data collected from 1999 to 2002 (African American Cohort, children ages 1-12 years).

Blinding used (if applicable): not applicable

Intervention (if applicable): not applicable

Statistical Analysis

- Nutrient analysis was accomplished using databases from the US Department of Agriculture (USDA) Agricultural Research Service
- Mean Adequacy Ratio (MAR) -
  - calculated by expressing micronutrient intake as a percentage of the Estimated Average Requirement (EAR), truncated to no more than 100%
  - then averaged over 13 micronutrients: Vitamins A, E, C, B_1, B_2, B_6, B_{12}, niacin, folate, P, Mg, Fe and Zn
  - A score of 90 and above was considered nutritionally adequate for MAR
  - the covariates used in comparing the three breakfast consumption groups (energy(kJ/kcal), gender and age (years)) were not used for MAR calculations
  - Unadjusted means for total energy and adjusted means of breakfast consumption groups were compared using the Bonferroni method to adjust the significance level for multiple comparisons.
- SUDAAN software
  - Used to adjust the variance for the complex sample design of the sample-weighted data analysis
  - The sample weighted percentages (and standard error (SE) of the percentages), of children in breakfast consumption groups were calculated using PROC CROSSTAB of SUDAAN
  - Unadjusted means and SE for total energy were also calculated using PROC DESCRIP of SUDAAN
  - Least-square means and SE were calculated using PROC REGRESS of SUDAAN.
- Statistical Analysis Software (SAS)
  - used to calculate percentiles and Z scores of BMI-for-age and weight-for-age
- P Value
  - There were three comparisons
    - breakfast skippers v. RTEC breakfast consumers
    - breakfast skippers v. other breakfast consumers
    - RTEC breakfast consumers v. other breakfast consumers
  - the α value of $P \leq 0.05$ was divided by 3, and the means of the groups were significantly different only of the P value of the contrast was <0.01667

Data Collection Summary:

Timing of Measurements

- A single, multiple-pass, 24 h dietary recall was conducted during the interview using computer-assisted software to record dietary intake data from participants.
  - Parents or caregivers reported dietary intakes for children less than 6 years of age
  - subjects aged 6-11 years were assisted by an adult
- Trained examiners completed an in-person interview and a physical exam of participants

Dependent Variables

- Weight status - children with BMI ≥ 95th percentile of BMI-for-age on the Centers for Disease Control and Prevention (CDC) Growth Charts were classified as overweight.
- Nutrient adequacy determined by MAR

Independent Variables

- Children were grouped into one of three categories:
  - 1) breakfast skippers (those who did not eat breakfast or brunch)
  - 2) RTEC breakfast consumers (regardless of what else was consumed at the breakfast/brunch meal)
  - 3) other breakfast consumers (no RTEC was consumed at the breakfast/brunch meal)

Control Variables

- Age
- Gender
- Energy intake

Description of Actual Data Sample:

Initial N: unclear, 1389 subjects identified in table 1

Attrition (final N): 1389 subjects

Age:1-12 years of age

Ethnicity:African American

Other relevant demographics:

		Breakfast Skippers						RTEC breakfast						Other Breakfast					
		Both Genders		Males		Females		Both Genders		Males		Females		Both Genders		Males		Females	
Age (years)	n	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
1-5	521	7.4	1.7	8.0	2.4	6.6	1.8	45.0	3.0	46.2	4.1	43.9	3.3	47.6	3.4	45.8	4.6	49.5	3.5
6-12	868	16.9	1.0	14.4	1.2	19.4	1.7	38.0	1.9	40.5	2.4	35.4	2.3	45.2	1.8	45.1	2.3	45.3	2.9

Anthropometrics

	Breakfast Skippers			RTEC breakfast			Other Breakfast		
	n	Mean	SE	n	Mean	SE	n	Mean	SE
BMI (kg/m2)									
2-12 years	180	19.8a	0.4	492	17.7b	0.2	565	18.5c	0.2
2-5 years	29	16.0	0.3	170	16.1	0.1	181	16.4	0.1
6-12 years	151	20.5a	0.4	322	18.5b	0.3	384	19.5a,b	0.2
Waist Circumference (cm)									
2-12 years	179	65.5a	1.2	485	58.8b	0.6	560	61.2c	0.6
2-5 years	28	50.7	1.0	171	50.2	0.4	182	51.0	0.4
6-12 years	151	68.2a	1.1	324	63.0b	0.6	383	65.6a	0.7
Overweight (%)									
2-12 years	180	26.1a	2.9	492	13.1b	1.7	565	18.5a,b	1.5
2-5 years	29	12.3	3.7	170	7.1	2.3	181	10.2	2.1
6-12 years	151	28.8a	3.2	322	16.2b	2.1	384	22.1a,b	1.8

a,b,cMean values within a row with unlike superscript letters were significantly different (P≤0.05); breakfast skippers v. RTEC breakfast consumers, breakfast skippers v. other breakfast consumers, RTEC breakfast consumers v. other breakfast consumers

Location:United States

Summary of Results:

Key Findings

- AA children who consumed RTEC for breakfast had lower mean BMI (P≤0.05) and waist circumference (P≤0.05) than those who either skipped breakfast or consumed other types of breakfast.
- There was a lower percentage of overweight children in the RTEC breakfast consumption group (13.1%) compared with breakfast skippers (26.1%), but there were no differences in the prevalence of overweight between the RTEC breakfast and the other breakfast consumption group.
- Compared with those who either skipped breakfast or consumed other breakfasts, children in the RTEC breakfast category had the highest mean daily intakes of vitamins A and B_{12}, thiamin, riboflavin, folate and Fe (P≤0.05 for all).
- RTEC breakfast consumers had higher intakes of vitamin B_6, niacin, Ca and Zn (P≤0.05) than the other two groups.
- RTEC breakfast consumers had a lower intake of vitamin E than breakfast skippers (P≤0.05)
- AA children aged 1-12 years who ate RTEC at breakfast had a higher percentage MAR than breakfast skippers or those consuming other breakfasts

(P≤0.05)
- Children who consumed RTEC for breakfast had the highest intakes from carbohydrate and total sugars and the lowest intake from total fat when compared with either breakfast skippers or other breakfast consumers (P≤0.05)
- RTEC breakfast consumers had lower SFA intake than other breakfast consumers (P≤0.05)
- Breakfast skippers and other breakfast consumers had higher intakes of MUFA and PUFA than RTEC breakfast consumers (P≤0.05)

	Breakfast skippers		RTEC breakfast		Other Breakfast	
	(n=188)		(n=560)		(n=641)	
Nutrient	Mean	SE	Mean	SE	Mean	SE
Total Energy (kJ)	6958a	310	8034b	113	8122b	134
Total Energy (kcal)	1662a	74	1919b	27	1940b	32
MAR (%)	84.3a	1.2	95.7b	0.2	93.2c	0.4
MAR (%) w/o milk on RTEC eaten at breakfast	84.3a	1.2	94.3b	0.3	93.2b	0.4
Vitamin A (µg RAE)	357a	22	581b	18	443c	17
α-Tocopherol (mg)	6.1a	0.2	5.0b	0.2	5.4b	0.1
Vitamin C (mg)	95.9	5.9	105.7	4.0	99.3	3.9
Thiamin (mg)	1.19a	0.04	1.74b	0.03	1.36c	0.03
Riboflavin (mg)	1.49a	0.04	2.26b	0.04	1.71c	0.03
Niacin (mg)	16.8a	0.4	21.9b	0.4	17.2a	0.4
Vitamin B_6 (mg)	1.28a	0.03	1.91b	0.03	1.32a	0.02
Folate (µg DFE)	357a	15	675b	24	411c	11
Vitamin B12 (µg)	3.2a	0.1	4.9b	0.2	3.7c	0.1
Ca (mg)	719a	19	866b	17	741a	15
P (mg)	1002a	16	1084b	13	1076b	11
Mg (mg)	198a,b	4	205a	3	195b	2
Fe (mg)	11.0a	0.3	16.6b	0.3	12.6c	0.2
Zn (mg)	8.6a	0.3	11.4b	0.2	9.0a	0.2
Na (mg)	2930	74	3031	43	3129	35
K (mg)	2037	45	2111	29	2050	32
Vitamin K (µg)	57.6	12.0	50.8	4.7	66.4	10.5

a,b,c Mean values within a row with unlike superscript letters were significantly different (P≤0.05); breakfast skippers v. RTEC breakfast consumers, breakfast skippers v. other breakfast consumers, RTEC breakfast consumers v. other breakfast consumers

Author Conclusion:

Consuming RTEC at breakfast was associated with improved weight and nutrient adequacy in AA children. AA children in all breakfast categories still had mean intakes of most nutrients below recommended levels. The implications are that consuming a breakfast meal should be encouraged in these children, and that RTEC at breakfast provides important nutrients and may help promote a healthy weight.

Reviewer Comments:

Numerous limitations were listed in the discussion:

- *Since NHANES is a cross sectional study, causal inferences cannot be drawn.*
- *Dietary intakes were self-reported and were subject to non-sampling errors, such as under-reporting of energy and examiner effects*
- *Parents or guardians who reported or assisted children with recalls may not know all foods that children in daycare or school consumed the previous day.*
- *24 hr dietary recalls may not accurately reflect the usual dietary patterns of participants.*
- *Children's self reported portion sizes may result in sizeable errors in quantitative estimates of food energy intakes.*
- *Physical Activity was not used as a covariate*
- *All RTEC were grouped together although the nutrient content could vary greatly*

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions

1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	N/A
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes

3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	N/A

Validity Questions

1.	**Was the research question clearly stated?**	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	**Was the selection of study subjects/patients free from bias?**	Yes
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	???
2.2.	Were criteria applied equally to all study groups?	Yes
2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	Yes
3.	**Were study groups comparable?**	Yes
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	Yes
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	Yes
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	N/A
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	Yes
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	Yes
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**	Yes
4.1.	Were follow-up methods described and the same for all groups?	Yes
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	Yes
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	Yes
4.4.	Were reasons for withdrawals similar across groups?	N/A
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	**Was blinding used to prevent introduction of bias?**	Yes
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	Yes
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	Yes
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	N/A

	6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	N/A
	6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
	6.6.	Were extra or unplanned treatments described?	N/A
	6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	N/A
	6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**		Yes
	7.1.	Were primary and secondary endpoints described and relevant to the question?	N/A
	7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
	7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	N/A
	7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
	7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
	7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
	7.7.	Were the measurements conducted consistently across groups?	Yes
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**		Yes
	8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
	8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
	8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
	8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
	8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
	8.6.	Was clinical significance as well as statistical significance reported?	Yes
	8.7.	If negative findings, was a power calculation reported to address type 2 error?	N/A
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**		Yes
	9.1.	Is there a discussion of findings?	Yes
	9.2.	Are biases and study limitations identified and discussed?	Yes
10.	**Is bias due to study's funding or sponsorship unlikely?**		Yes
	10.1.	Were sources of funding and investigators' affiliations described?	Yes
	10.2.	Was the study free from apparent conflict of interest?	Yes